



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/536,801	12/09/2005	Graham R Eastham	31229-218465	4528
26594	7590	06/17/2009		
VENABLE LLP P.O. BOX 34385 WASHINGTON, DC 20043-9998			EXAMINER OH, TAYLOR V	
			ART UNIT	PAPER NUMBER
			1625	
			MAIL DATE	DELIVERY MODE
			06/17/2009	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/536,801

**Applicant(s)**

EASTHAM ET AL.

**Examiner**

Taylor Victor Oh

**Art Unit**

1625

**Period for Reply** -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 17 April 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 2,3,5-8,10-23 and 27-33 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 2,3,5-8,10-23 and 27-33 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB-08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

The Status of Claims:

Claims 2-3,5-8,10-23,27-33 are pending.

Claims 2-3,5-8,10-23,27-33 are rejected.

DETAILED ACTION

1. Claims 2-3,5-8,10-23,27-33 are under consideration in this Office Action.

Priority

2. It is noted that this application is a 371 of PCT/GB03/04679(10/31/03), which has a foreign priority document, United Kingdom 0228018.8(11/30/2002).

Drawings

3. None.

Election/Restriction

The previous Restriction has been withdrawn due to applicants' persuasive argument.

***Claim Objections***

Claims 10 and 23 are objected to because of the following informalities:

In claim 10 ,there is no period at the end of the claim. Appropriate correction is required.

In claim 23 , the phrase " also known as " is recited. This expression is improper in the claimed language. Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 2-3,5-8,10-23,27-33 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 3, the chemical term "Het" is recited. The expression is vague and indefinite because the skilled artisan in the art is unable to figure out what kind of "Het" can be for the K,D,E,Z, R<sup>1</sup> to R<sup>18</sup> and R<sup>19</sup> to R<sup>27</sup> and R<sup>43</sup> to R<sup>48</sup> groups. Therefore, an appropriate correction is required.

In claims 3, and 11,30-31 the terms "a bridging group comprising an optionally substituted aryl moiety", "hydroxyl group-containing compound", "a product comprising a branched (iso)product and chemically treated said branched (iso) product", and "a product comprising a linear(n)product and chemically treated said linear (n) product" are recited. The expression is vague and indefinite because the terms such as "comprising or containing" would mean that there are some additional components besides an optionally substituted aryl moiety in the bridging group, hydroxyl group in the compound, a branched (iso)product and chemically treated said branched (iso) product present in the product, and a linear(n)product and chemically treated said linear (n) product in the product; the skilled artisan in the art is unable to figure out what else are present in the corresponding compound. Therefore, an appropriate correction is required.

In claim 3 , 30-31 the phrases “an optionally substituted aryl moiety” and “aryl moiety which may be substituted” are recited.

The expression is vague and indefinite because in the absence of the specific moieties intended to effectuate modification by the “substitution” or attachment to the chemical core claimed, the term “substituted” renders the claims in which it appears indefinite in all occurrences wherein applicants fails to articulate by chemical name, structural formula or sufficiently distinct functional language, the particular moieties applicants regards as those which will facilitate substitution, requisite to identifying the composition of matter claimed. Therefore, an appropriate correction is required.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 2-3,5-8,10-23,27-33 are rejected under 35 U.S.C. 112, first paragraph, because being enabling for carbonylation of vinyl ester compound of formula (IV) having non-Het substitutes as starting materials, this does not reasonably provide enablement for all kinds of the Het substitutes for the vinyl ester compound of formula (IV) . The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to include all kinds of starting materials containing the Het substitutes for the vinyl ester compound of formula (IV) unrelated to the currently claimed invention commensurate in scope with these claims.

The specification falls short because data essential for how all kinds of Het compounds attached to formula (IV) would be led to forming the final desired compounds by the carbonylation process.

In In re Wands, 8 USPQ2d 1400 (1988), factors to be considered in determining whether a disclosure meets the enablement requirement of 35 U.S.C. § 112, first paragraph, have been described. They are:

1. the nature of the invention,
2. the state of the prior art,
3. the predictability or lack thereof in the art,
4. the amount of direction or guidance present,
5. the presence or absence of working examples,
6. the breadth of the claims,
7. the quantity of experimentation needed, and
8. the level of the skill in the art.

### ***The Nature of the Invention***

The nature of the invention in claims 3,30, 31 is the process for carbonylation of vinyl ester compound of formula (IV) with carbon monoxide in the presence of a catalyst system or the process for the production of a lactate ester or acid of formula (II) by carbonylation of vinyl ester compound of formula (IV) with carbon monoxide in the presence of a catalyst system or the process for the production of a 3-hydroxy propanoate ester or acid of formula (III) by carbonylation of vinyl ester compound of formula (IV) with carbon monoxide in the presence of a catalyst system.

### ***The State of the Prior Art***

The states of the prior art are described as followed:

Tjaden et al discloses the process of producing epsilon caprolactones and /or esters thereof in the followings:

This invention also relates to processes for producing one or more substituted or unsubstituted epsilon caprolactones, e.g., epsilon caprolactone, and/or hydrates and/or esters thereof which comprise: (a) subjecting one or more substituted or unsubstituted alkadienes, e.g., butadiene, to hydrocarbonylation in the presence of a hydrocarbonylation catalyst, e.g., a metal-organophosphorus ligand complex catalyst, to produce one or more substituted or unsubstituted penten-1-ols; and (b) subjecting said one or more substituted or unsubstituted penten-1-ols to carbonylation in the presence of a carbonylation catalyst, e.g., a metal-organophosphorus ligand complex catalyst, to produce said one or more substituted or unsubstituted epsilon caprolactones and/or hydrates and/or esters thereof. The hydrocarbonylation reaction conditions in step (a) and the carbonylation reaction conditions in step (b) may be the same or

different. The hydrocarbonylation catalyst in step (a) and the carbonylation catalyst in step (b) may be the same or different.

Furthermore, other olefinic starting materials include 1,3-dienes, vinyl acetate, 3-butenyl acetate, vinyl propionate.

Examples of suitable bidentate phosphine ligands according to the invention are 1,1'-bis (diphenylphosphino)

ferrocene; 1,1'-bis(diisopropylphosphino)ferrocene; 1,1'-bis(diisobutylphosphino)ferrocene; 1,1'-bis(dipropylphosphino)ferrocene; 1,1'-bis(dicyclohexylphosphino)ferrocene; 1,1'-bis(isopropylcyclohexylphosphino)ferrocene; 1,1'-bis(ditertbutylphosphino)ferrocene; 1-(diisopropylphosphino)1'-(phenylisopropylphosphino)ferrocene; 1,1'-bis(di-2-thiophenylphosphino)ferrocene; 1-(diisopropylphosphino)-1'-(diphenylphosphino)ferrocene; 1,1'-bis(isopropylphenylphosphino)ferrocene; and 1,1'-bis(di-2-thiophenylphosphino)ferrocene.

Drent et al discloses the process for the carbonylation of an olefin in the followings:

(10) The invention relates to a process for the carbonylation of olefins in which process an olefin is reacted with carbon monoxide in the presence of an alcohol or water and of a catalyst system, obtainable by combining:

(a) a metal of Group VIII or a compound thereof and

(b) a bidentate phosphine, arsine and/or stibine derivative, wherein as bidentate (b) a compound is selected having the general formula



wherein  $M^1$  and  $M^2$  are independently P, As or Sb, R is a divalent organic bridging group with at least 2 carbon atoms in the bridge, and  $R^1-R^4$  represent the same or different optionally substituted tertiary alkyl groups. The invention further relates to a catalyst system suitable for this process.

Table 1 (Cont.)

Example No	Catalyst components (mmol)	Alkanol, etc. (ml)		Pressure (bar)		Temperature (°C)
		olefin		CO	other	
XII	0.25 palladiumacetate	20 methanol	vinylacetate			75
	0.6 1,3-bis(di-tert-butylphosphino)-propane	40 diglyme	(20 ml)	40		
	0.5 tert-butylsulphonic acid					



As the prior art have been discussed in the above, there is no conclusive data that all kinds of Het compounds present in the formula (IV) would be enabled to produce the final desired product.

***The predictability or lack thereof in the art***

In the instant case, the instant claimed invention is highly unpredictable since one skilled in the art would recognize that any Het compounds present in the formula (IV) would not behave in the same way as the non-Het compounds present in the formula (IV). For example, the following heterocyclic or heteroaromatic groups, such as furanyl, pyrrolidinyl, pyrimidinyl, quinolinyl are attached to the core structure of the formula (IV). The physical properties of those groups are specified below in the followings:

**Furan**  
**RN: 110-00-9**



Physical Property	Value	Units
Melting Point	-8.58E-01	deg C
Boiling Point	31.5	deg C
log P (octanol-water)	1.34	(none)
Water Solubility	1.00E+04	mg/L
Vapor Pressure	590	mm Hg
Henry's Law Constant	5.40E-03	atm-m <sup>3</sup> /mole
Atmospheric OH Rate Constant	4.05E-11	cm <sup>3</sup> /molecule-sec

**Pyrrole**  
 RN: 109-97-7



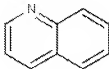
Physical Property	Value	Units
Melting Point	-2.34E+01	deg C
Boiling Point	125.7	deg C
pKa Dissociation Constant	17.5	(none)
log P (octanol-water)	0.75	(none)
Water Solubility	4.50E+04	mg/L
Vapor Pressure	8.36	mm Hg
Henry's Law Constant	1.80E-05	atm-m <sup>3</sup> /mole
Atmospheric OH Rate Constant	1.10E-10	cm <sup>3</sup> /molecule-sec

**Pyrimidine**  
**RN: 289-95-2**



Physical Property	Value	Units
Melting Point	22	deg C
Boiling Point	123.8	deg C
pKa Dissociation Constant	1.23	(none)
log P (octanol-water)	-0.4	(none)
Water Solubility	1.00E+08	mg/L
Vapor Pressure	12.5	mm Hg
Henry's Law Constant	2.92E-06	atm-m <sup>3</sup> /mole
Atmospheric OH Rate Constant	2.30E-13	cm <sup>3</sup> /molecule-sec

**Quinoline**  
**RN: 91-22-5**



Physical Property	Value	Units
Melting Point	-1.48E+01	deg C
Boiling Point	237.1	deg C
pKa Dissociation Constant	4.9	(none)
log P (octanol-water)	2.03	(none)
Water Solubility	6110	mg/L
Vapor Pressure	0.06	mm Hg
Henry's Law Constant	1.87E-03	atm-m <sup>3</sup> /mole
Atmospheric OH Rate Constant	1.16E-11	cm <sup>3</sup> /molecule-sec

When the melting point, the boiling point, and the water solubility of each of the above groups are compared with one and another, the skilled artisan in the art would readily be noticeable that each group requires the unique reaction conditions for each reaction process to occur due to their wide variety of the physical properties. Because of those differences among them in any reaction process, they must have different modes of operation, different functions or different effects because each of their reactants has not only a completely different chemical structure with respect to the core structure, but also, each requires the unique reaction conditions for the reaction to take place.

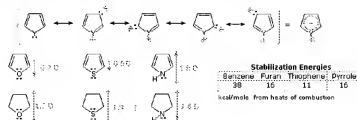
Furthermore, there is a comparison date regarding the difference of stabilization energies among benzene and heteroaromatic compounds, which can lead to the different reactivity during the reaction process as shown below:

# Reactions

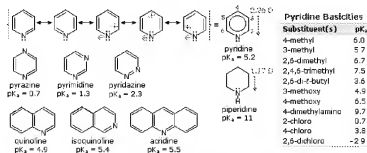
The chemical reactivity of the saturated members of this class of heterocycles: tetrahydrofuran, thiolane and pyrrolidine, resemble that of acyclic ethers, sulfides, and 2°-amines, and will not be described here. 1,3-Dioxolanes and dithiolanes are cyclic acetals and thioacetals. These units are commonly used as protective groups for aldehydes and ketones, and may be hydrolyzed by the action of aqueous acid.

It is the "aromatic" unsaturated compounds, furan, thiophene and pyrrole that require our attention. In each case the heteroatom has at least one pair of non-bonding electrons that may combine with the four  $\pi$ -electrons of the double bonds to produce an annulene having an aromatic sextet of electrons. This is illustrated by the resonance description at the top of the following diagram. The heteroatom Y becomes  $sp^2$ -hybridized and acquires a positive charge as its electron pair is delocalized around the ring. An easily observed consequence of this delocalization is a change in dipole moment compared with the analogous saturated heterocycles, which all have strong dipoles with the heteroatom at the negative end. As expected, the aromatic heterocycles have much smaller dipole moments, or in the case of pyrrole a large dipole in the opposite direction. An important characteristic of aromaticity is enhanced thermodynamic stability, and this is usually demonstrated by relative heats of hydrogenation or heats of combustion measurements. By this standard, the three aromatic heterocycles under examination are stabilized, but to a lesser degree than benzene.

Additional evidence for the aromatic character of pyrrole is found in its exceptionally weak basicity ( $pK_b$  ca. 0) and strong acidity ( $pK_a = 15$ ) for a 2°-amine. The corresponding values for the saturated amine pyrrolidine are: basicity 11.2 and acidity 32.



Moreover, regarding their identities of the individual heterocyclic or heteroaromatic compounds during the reaction process, there is a noticeable  $pK_a$  value difference among pyridine, pyrazine, pyrimidine, pyridazine, quinoline, isoquinoline, acridine, and etc below:



The diazines pyrazine, pyrimidine and pyridazine are all weaker bases than pyridine due to the inductive effect of the second nitrogen. However, the order of base strength is unexpected. A consideration of the polar contributors helps to explain the difference between pyrazine and pyrimidine, but the basicity of pyridazine seems anomalous. It has been suggested that electron pair repulsion involving the vicinal nitrogens destabilizes the neutral base relative to its conjugate acid.

All the above evidence do suggest that the presence of the different types of the heterocyclic or heteroaromatic moieties in the compounds can lead to the behavior of the compounds in an unpredictable way.

Thus, this becomes more prominent when the reactants containing heterocyclic or heteroaromatic groups in the compounds are compared with the ones with the non-hetero aromatic or cyclic groups in the compounds with respect to the reactivity or unexpected side effects during the course of the reaction process.

Therefore, the use of a generic term, Het substituent in the formula (IV), can not be assumed to produce the desired product in the claimed process in a predictable way.

### ***The presence or absence of working examples***

There are 7 working examples using the same starting vinyl acetate material for the carbonylation process in the specification. But there are no other examples of heterocyclic compound or heteroaromatic moieties in the formula (IV) as the starting materials for the carbonylation process. This can not be the representatives for all workable compounds of the formulas (IV). Therefore, the specification fails to provide sufficient working examples as to how all the possible variations of heterocyclic compound or heteroaromatic moieties in the formula (IV) starting materials can be carbonylated in the claimed process and be resulted in the desired claimed products, i.e. again, there is no correlation between any heterocyclic compound or heteroaromatic moieties in the formula (IV) starting materials and the desired final products.

***The quantity of experimentation needed***

The quantity of experimentation needed is undue experimentation. One of skill in the art would need to determine which one of heterocyclic compound or heteroaromatic moieties in the formula (IV) as the starting material would be resulted in the claimed desired compounds by the carbonylation and would furthermore then have to determine which one of heterocyclic compound or heteroaromatic moieties in the formula (IV) as the starting material would not be resulted in the claimed desired compounds.

Therefore, in view of the Wands factors and In re Fisher (CCPA 1970) discussed above, to practice the claimed invention herein, a person of skill in the art would have to engage in undue experimentation to test for which one of the heterocyclic compound or heteroaromatic moieties in the formula (IV) as the starting material by the carbonylation can be employed to produce the desired claimed compound encompassed in the instant claims, with no assurance of success.

Claims 2-3,5-8,10-23,27-33 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a metal of group VIII B or a compound thereof and a bidentate phosphine, arsine, or stibene of formula (I) containing ferrocene as a Het compound containing catalyst system does not reasonably provide enablement for all kinds of Het compounds present in the formula (I). The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to include all kinds of Het compounds present

in the formula (I) unrelated to the claimed invention commensurate in scope with these claims.

Furthermore, the instant specification fails to provide information that would allow the skilled artisan to practice the instant invention without undue experimentation. Attention is directed to *In re Wands*, 8 USPQ2d 1400 (CAFC 1988) at 1404 where the court set forth the eight factors to consider when assessing if a disclosure would have required undue experimentation, citing *Ex Parte Forman*, 230 USPQ 546 (BdApls 1986) at 547 the court recited eight factors:

- 1) the quantity of experimentation necessary,
- 2) the amount of direction or guidance provided,
- 3) the presence or absence of working examples,
- 4) the nature of the invention,
- 5) the state of the prior art,
- 6) the relative skill of those in the art,
- 7) the predictability of the art, and
- 8) the breath of the claims.

### ***The Nature of the Invention***

The nature of the invention in claims 3,30-31 is the process for the carbonylation of vinyl ester comprising reacting a vinyl ester compound of formula (IV) in the presence of a catalyst system composing of a metal of group VIII B or a compound thereof and a bidentate phosphine, arsine, or stibene of formula (I) or the process for the production of a lactate ester or acid of formula II comprising the steps of



carbonylating a an ester compound of formula (IV) in the presence of a catalyst system composing of a metal of group VIIIB or a compound thereof and a bidentate phosphine , arsine, or stibene of formula (I) , or the process for the production of a a 3-hydroxy propanoate ester or acid of formula(III) comprising the steps of carbonylating a vinyl ester compound of formula (IV) in the presence of a catalyst system composing of a metal of group VIIIB or a compound thereof and a bidentate phosphine , arsine, or stibene of formula (I)

### ***The State of the Prior Art***

The states of the prior art are described as followed:

Tjaden et al discloses the process of producing epsilon caprolactones and /or esters thereof in the followings:

This invention also relates to processes for producing one or more substituted or unsubstituted epsilon caprolactones, e.g., epsilon caprolactone, and/or hydrates and/or esters thereof which comprise: (a) subjecting one or more substituted or unsubstituted alkadienes, e.g., butadiene, to hydrocarbonylation in the presence of a hydrocarbonylation catalyst, e.g., a metal-organophosphorus ligand complex catalyst, to produce one or more substituted or unsubstituted penten-1-ols; and (b) subjecting said one or more substituted or unsubstituted penten-1-ols to carbonylation in the presence of a carbonylation catalyst, e.g., a metal-organophosphorus ligand complex catalyst, to produce said one or more substituted or unsubstituted epsilon caprolactones and/or hydrates and/or esters thereof. The hydrocarbonylation reaction conditions in step (a) and the carbonylation reaction conditions in step (b) may be the same or

]

different. The hydrocarbonylation catalyst in step (a) and the carbonylation catalyst in step (b) may be the same or different.

Furthermore, other olefinic starting materials include 1,3-dienes, vinyl acetate, 3-butenyl acetate, vinyl propionate.

Examples of suitable bidentate phosphine ligands according to the invention are 1,1'-bis (diphenylphosphino)

ferrocene; 1,1'-bis(diisopropylphosphino)ferrocene; 1,1'-bis(diisobutylphosphino)ferrocene; 1,1'-bis(dipropylphosphino)ferrocene; 1,1'-bis(dicyclohexylphosphino)ferrocene; 1,1'-bis(isopropylcyclohexylphosphino)ferrocene; 1,1'-bis(ditertbutylphosphino)ferrocene; 1-(diisopropylphosphino)1'-(phenylisopropylphosphino)ferrocene; 1,1'-bis(di-2-thiophenylphosphino)ferrocene; 1-(diisopropylphosphino)-1'-(diphenylphosphino)ferrocene; 1,1'-bis(isopropylphenylphosphino)ferrocene; and 1,1'-bis(di-2-thiophenylphosphino)ferrocene.

Drent et al discloses the process for the carbonylation of an olefin in the following:

② The invention relates to a process for the carbonylation of olefins in which process an olefin is reacted with carbon monoxide in the presence of an alcohol or water and of a catalyst system, obtainable by combining:

(a) a metal of Group VIII or a compound thereof and

(b) a bidentate phosphine, arsine and/or stibine derivative, wherein as bidentate (b) a compound is selected having the general formula



wherein M<sup>1</sup> and M<sup>2</sup> are independently P, As or Sb, R is a divalent organic bridging group with at least 2 carbon atoms in the bridge, and R<sup>1</sup>-R<sup>4</sup> represent the same or different optionally substituted tertiary alkyl groups. The invention further relates to a catalyst system suitable for this process.

Table 1 (Cont.)

Example No	Catalyst components (mmol)	Alkanol, etc. (ml)	Pressure (bar)			Temperature (°C)
			olefin	CO	other	
XII	0.25 palladiumacetate	20 methanol	vinylacetate			75
	0.6 1,3-bis(di-tert. butylphosphino)- propane	40 diglyme	(20 ml)	40		
	0.5 tert.butylsulpho- nic acid					

As the prior art have been discussed in the above, there is no conclusive data that all kinds of Het compounds present in the formula (I) would be enabled to produce the final desired product.

***The predictability or lack thereof in the art***

In the instant case, the instant claimed invention is highly unpredictable since one skilled in the art would recognize that any Het compounds present in the formula (I) of the catalyst system would not work on the claimed process in the same way as the 1,2-bis-(ditertbutylphosphinomethyl)ferrocene disclosed in the specification. For example, the instant specification reveals that the pKa value should be less than 3 or 4, which does not interfere with the reaction e.g. metal salts; claims do read on any Het compounds present in the formula (I) of the catalyst system comprising piperidine, quinoline, isoquinoline, whose pKa values are 11, 4.9, and 5.4 respectively according to William Reusch (Virtual Text of Organic Chemistry, 1999). From this evidence, it becomes clear that not all Het compounds can be used for the claimed process due to the variation of the pKa value which would interfere with the reaction process.

Moreover, the case law advocates that the catalyst compositions represent an unpredictable aspect in the art of organic chemistry . See Exparte Sizto, 9 USPQ2d 2081 (Bd. Of App. And Inter. March 1988). Therefore, the use of a generic phrase , a Het moiety present in the formula (I) can not ensure to form the desired claimed product in a good yield.

***The amount of direction or guidance present***

The direction present in the instant specification is that not any Het compounds present in the formula (I) of the catalyst system can be led to the formation of the desired product. According to the specification, it is silent as to how any Het moiety present in the formula (I) of the catalyst system can be led to the formation of the desired product and fails to provide guidance as to whether any Het compounds present in the formula (I) of the catalyst system is sufficient enough to allow to form the desired product in sufficient quantities; the specification fails to provide a correlation between the claimed process of the invention and the functional language of any Het compounds present in the formula (I) of the catalyst system.

***The presence or absence of working examples***

There are only 3 working ligand examples :

**NB "ligand" is 1,2 –bis (di-tert-butylphosphinomethyl) benzene**  
**Me ligand is 1,2-bis (di-tert-butyl phosphinomethyl) ferrocene**  
**"Ad Ligand" is 1,2 bis (diadamantylphosphinomethyl) benzene**

using in the part of the catalyst system as described in the specification. This can not be the representatives for all Het compounds present in the formula (I) of the catalyst system which would work for the claimed process. Thus, the specification fails to provide working examples as to how the other types of Het compounds present in the formula (I) of the catalyst system can be resulted in the claimed products, i.e. again, there is no correlation between the functional language of any Het compounds present in the formula (I) of the catalyst system and the desired final product.

### ***The breadth of the claims***

The breadth of the claims is that any Het compounds present in the formula (I) of the catalyst system would work on the claimed process in the same way as those exemplified ligands in the formula (I) of the catalyst system without considering the affect or impact of the different Het compounds present in the formula (I) of the catalyst system on the starting compound , thereby affecting the yield of the desired final product.

### ***The quantity of experimentation needed***

The quantity of experimentation needed is undue experimentation. One of skill in the art would need to determine which one of any Het compounds present in the formula (I) of the catalyst system would be capable of forming the desired product and would furthermore then have to determine which one of any Het compounds present in the formula (I) of the catalyst system would not be resulted in the claimed desired compounds in a sufficient quantity.

Therefore, in view of the Wands factors and *In re Fisher* (CCPA 1970) discussed above, to practice the claimed invention herein, a person of skill in the art would have to engage in undue experimentation to test which any Het compounds present in the formula (I) of the catalyst system can be employed to produce the desired claimed compound encompassed in the instant claims, with no assurance of success.

***Claim Rejections - 35 USC § 103***

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 3, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Drent et al (EP0495548) in view of Tjaden et al ( US 6,307,065).

Drent et al discloses the process for the carbonylation of an olefin in the following (see abstract page):

Ⓒ The invention relates to a process for the carbonylation of olefins in which process an olefin is reacted with carbon monoxide in the presence of an alcohol or water and of a catalyst system, obtainable by combining:  
(a) a metal of Group VIII or a compound thereof and  
(b) a bidentate phosphine, arsine and/or stibine derivative, wherein as bidentate (b) a compound is selected having the general formula



wherein M<sup>1</sup> and M<sup>2</sup> are independently P, As or Sb, R is a divalent organic bridging group with at least 2 carbon atoms in the bridge, and R<sup>1</sup>-R<sup>4</sup> represent the same or different optionally substituted tertiary alkyl groups. The invention further relates to a catalyst system suitable for this process.

Table I (Cont.)

Example No	Catalyst components {mol}	Alkanol, etc. {ml}	Pressure (bar)		Temperature {°C}
			olefin	CO other	

XII	0.25 palladiumacetate	20 methanol	vinylacetate	75
	0.6 1,3-bis(di-tert. butylphosphino)- propane	40 diglyme	(20 ml) 40	
	0.5 tert.butylsulpho- nic acid			

(see page 8 ,table I).

Table II (Cont.)

Example No	Reaction rate (mol/gat.h)	Product selectivity (%)	
XII	200	1-acetoxy methyl propionate	40
		2-acetoxy methyl propionate	60

(see page 11, table II)

The amount of catalyst used in the process is not critical. Good results are obtained when the amount of Group VIII metal is in the range of  $10^{-7}$  to  $10^{-1}$  gat per mole of olefinic double bond to be carbonylated. Preferably this amount is in the range of  $10^{-5}$  to  $5.10^{-2}$  gat per mole.

(see page 3 ,lines 29-31).

The carbon monoxide required for the reaction may be supplied in substantially pure form, or contaminated with in general minor amounts of inert compounds such as nitrogen, hydrogen and the like. The presence of sulphur containing contaminants such as COS or some metal compounds e.g. metal carbonyl compounds, should be avoided.

Hydrogen or a hydrogen containing gas may be present as a diluent for the carbon monoxide and other gaseous reactants. The pressure at which the hydrogen is supplied may vary, but is usually not more than that of the CO partial pressure.

(see page 4 ,lines 11-18).

The instant invention, however, differs from the prior art in that the part of the bidentate is an aryl compound.



Tjaden et al discloses the process of producing epsilon caprolactones and /or esters thereof in the followings (see from col. 1, line 52 to col. 2 ,line 3):

This invention also relates to processes for producing one or more substituted or unsubstituted epsilon caprolactones, e.g., epsilon caprolactone, and/or hydrates and/or esters thereof which comprise: (a) subjecting one or more substituted or unsubstituted alkadienes, e.g., butadiene, to hydrocarbonylation in the presence of a hydrocarbonylation catalyst, e.g., a metal-organophosphorus ligand complex catalyst, to produce one or more substituted or unsubstituted penten-1-ols; and (b) subjecting said one or more substituted or unsubstituted penten-1-ols to carbonylation in the presence of a carbonylation catalyst, e.g., a metal-organophosphorus ligand complex catalyst, to produce said one or more substituted or unsubstituted epsilon caprolactones and/or hydrates and/or esters thereof. The hydrocarbonylation reaction conditions in step (a) and the carbonylation reaction conditions in step (b) may be the same or ]

different. The hydrocarbonylation catalyst in step (a) and the carbonylation catalyst in step (b) may be the same or different.

Furthermore, other olefinic starting materials include 1,3-dienes, vinyl acetate, 3-butenyl acetate, vinyl propionate (see col. 18, lines 52-67).

Examples of suitable bidentate phosphine ligands according to the invention are 1,1'-bis (diphenylphosphino)

ferrocene; 1,1'-bis(diisopropylphosphino)ferrocene; 1,1'-bis(diisobutylphosphino)ferrocene; 1,1'-bis(dipropylphosphino)ferrocene; 1,1'-bis(dicyclohexylphosphino)ferrocene; 1,1'-bis(isopropylcyclohexylphosphino)ferrocene; 1,1'-bis(ditertbutylphosphino)ferrocene; 1-(diisopropylphosphino)1'-(phenylisopropylphosphino)ferrocene; 1,1'-bis(di-2-thiophenylphosphino)ferrocene; 1-(diisopropylphosphino)-1'-(diphenylphosphino)ferrocene; 1,1'-bis(isopropylphenylphosphino)ferrocene; and 1,1'-bis(di-2-thiophenylphosphino)ferrocene.

(see from col. 24 ,line 66 to col. 25, line 10).

#### EXAMPLE 32

A 100 milliliter overhead stirred high pressure reactor was charged with 0.28 mmol palladium(II) acetate, 0.55 mmol of bis(2,2'-diphenylphosphinomethyl)biphenyl, 2.7 mmol methane sulfonic acid, 2 milliliters of water, 1.5 milliliters of 3-pentenol, 24 milliliters of 1,4-dioxane, and 1 milliliter of diglyme as internal standard. The reactor was pressurized with 10 psi carbon monoxide, heated to 130° C., and then pressurized to 1500 psi carbon monoxide. Samples of the reaction mixture were taken at time zero and after 2 hours, and then analyzed by gas chromatography. At the end of the reaction (2 hours), the gases were vented and the reaction mixture drained. Details of the reaction are set out in Table E.

(see col. 36, lines 12-25).

Recovery and purification of unsaturated alcohols may be by any appropriate means, and may include distillation, phase separation, extraction, precipitation, absorption, crystallization, membrane separation, derivative formation and other suitable means. For example, a crude reaction product can be subjected to a distillation-separation at atmospheric or reduced pressure through a packed distillation column. Reactive distillation may be useful in conducting the hydrocarbonylation reaction.

( see col. 20 ,lines 52-60).

Drent et al discloses expressly the process for the carbonylation of the vinyl acetate in the presence of the alcohol and the catalyst system containing palladium and the bidentate; similarly, Tjaden et al does disclose the process for the carbonylation of the vinyl acetate in the presence of the alcohol and the catalyst system containing the palladium and the bi(2,2'-diphenylphosphinomethyl)biphenyl bidentate (see col. 36, lines 12-25). Furthermore, the reactive distillation may be useful in conducting the hydrocarbonylation reaction. Therefore, it would have been obvious to the skilled artisan in the art to be motivated to use Tjaden's et al bi(2,2'-diphenylphosphinomethyl)biphenyl as an alternative in the Drent et al process. This is because both processes are commonly involved in the carbonylation process using the same palladium metal and the similar bidentates; the skilled artisan in the art would expect such a manipulation to be successful and feasible as guidance shown in the prior art.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Taylor Victor Oh whose telephone number is 571-272-0689. The examiner can normally be reached on 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Janet Andres can be reached on 571-272-0867. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Taylor Victor Oh, MSD,LAC  
Primary Examiner  
Art Unit :1625

/Taylor Victor Oh/  
Primary Examiner, Art Unit 1625  
6/16/09